AD-A096 520 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG--ETC F/G 9/2
H2251 - CALCULATION OF OUTLET WORKS LOSS COEFFICIENT FROM PROTO--ETC(U)
FEB 79 B J BROWN

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ELECTRONIC COMPUTER PROGRAM ABSTRACT

TITLE OF PROGRAM H2251 - Calculation of Outlet Works Loss Coefficient from Prototype Measurement of Drawdown	**PROGRAM NO.** 722-F3-RØ-2D1

PREPARING AGENCY Hydraulic Analysis Division, Hydraulics Laboratory, U. S. Army Engineer Waterways Experiment Station, P. O. Box 631, Vicksburg, MS 39180

AUTHOR(S)	DATE PROGRAM COMPLETED	STATUS OF PROGRAM: PHASE	STATUS OF PROGRAM: STAGE
Bobby J. Brown	February 1979	Origin	Operational

A. PURPOSE OF PROGRAM

To compute the loss coefficient of a reservoir outlet works for a given gate opening from drawdown data given the stage versus reservoir volume relation and knowing the average inflow rate (may be zero) during the observation period of drawdown.

Reference: Moore, E. T., "Reservoir Storage Evacuation Time by Integration," Civil Engineering, April 1971.

B. PROGRAM SPECIFICATIONS

SEE FOLLOWING PAGE.

C. METHODS

The program is written in G635 time-share series, FORTRAN IV, and is part of a Conversationally Oriented Real-Time Program-Generating System (CORPS). The program consists of a main program. This main program handles all I/O requirements, computations, and writing.

D. EQUIPMENT DETAILS

The program was developed and is operational on the WES G635, Vicksburg, MS. It is also operational on HIS 66/8Ø, Macon, GA, and Boeing CDC, Seattle, WA.

E. INPUT-OUTPUT

Input requirements are: observation period of drawdown in hours, initial and final gage heights of water surface in ft above outlet intake invert, outlet conduit cross-sectional area in ft^2, coefficients of power curve to data of gage height (ft) versus reservoir storage (acre-ft), and the average inflow into the reservoir in acre-ft/hr. Output includes the given input data and the loss coefficient of the outlet conduit.

F. ADDITIONAL REMARKS

Complete documentation of this program is available from the Engineer Computer Programs Library, Technical Information Center. WES.

ENG FORM 2883 1 AUG 60 PREVIOUS EDITIONS ARE OBSOLETE.

B. PROGRAM SPECIFICATIONS:

Language: ANSI FORTRAN (FORTRAN IV)

Solution Requirements: The run command

RUN WESLIB/CORPS/H2251,R

and the inputs defined in E.

Method of Analysis: Numerical integration of the continuity equation combined with the stage versus outflow and stage versus reservoir storage relationships.

Core Requirements G635: 11 K words

External Storage: None

Restrictions: Period of observation of drawdown should be less than 24 hours to meet computational limitation of the GE 637 computer system.

General Equation: Continuity equation

$$Q - B = \frac{d\forall}{dt}$$

where Q is the outflow, B is a constant inflow and $\frac{d\forall}{dt}$ is the change in storage.

REF: ER 1110-1-10 - ENGINEERING AND DESIGN - Engineering and Computer Program Library Standards and Documentation, Appendix B

PART I: ENGINEERING DESCRIPTION

1. PROGRAM NUMBER: 722-F3-RØ-2D1

2. TITLE: H2251 - Computation of Loss Coefficient for an Outlet Works from Prototype Drawdown Data.

3. REVISION LOG: N/A

4. PURPOSE OF PROGRAM: To compute the loss coefficient of a reservoir outlet works for a given gate opening from drawdown data given the stage versus reservoir volume relation and knowing the average inflow rate (may be zero) during the observation period of drawdown.

Reference: Moore, E. T., "Reservoir Storage Evacuation Time by Integration," Civil Engineering, April 1971.

5. STEP SOLUTION:

a. Input. The input variables that must be defined prior to executing the program are:

(1) The observation period of drawdown in hours, i.e., the time required for the reservoir water surface to fall from an upper level to some lower level. The time should be limited to less than 24 hours to avoid computational errors described in paragraph 5c.

(2) The initial and final gage height of the reservoir water surface in ft above a datum such as the invert of the outlet works intake. Any datum is satisfactory provided it is also used in the gage height versus reservoir volume relationship in (4) below.

(3) The cross-sectional area of the outlet conduit in ft^2.

(4) The coefficients of a power curve fit to the plot of gage height (ft) versus reservoir volume (acre-ft). A straight

line is fitted to the log-log plot and the equation has the form:

$$Y = AX^B$$

where Y is the reservoir volume (acre-ft), X is the gage height (ft) (the same datum use in (2) above is required), and A and B are the coefficients required by the program.

(5) The average inflow into the reservoir during the observation period in acre-ft per hour. Zero inflow is the most desirable inflow condition because it simplifies the solution.

b. Theoretical Formulation. Formulation of the problem is derived from the continuity principle: i.e., outflow minus inflow equal to a change in storage or:

$$Q - B = \frac{d\forall}{dt} \tag{1}$$

where Q is the outflow, B is a constant inflow and $\frac{d\forall}{dt}$ is the change in storage or volume in the reservoir. The outflow (Q) is defined by:

$$Q = A\sqrt{\frac{2gh}{K}}\ (\text{cfs}) = 0.0826A\sqrt{\frac{2gh}{K}}\ (\text{acre-ft/hr}) \tag{2}$$

where A is the cross-sectional area of the outlet conduit (ft^2), h is the total head (ft), g is the acceleration of gravity (32.2 ft/sec^2) and K is the outlet works loss coefficient. Flow rates in this formulation are expressed in acre-ft/hr because of the common practice of expressing reservoir storage in units of acre-ft.

The reservoir volume or storage is expressed by a power function of gage height, i.e.,

$$\forall = Ch^{D} \tag{3}$$

where $\forall$ is the reservoir volume (acre-ft) and h is the gage height or head (must correspond to h in equation 2). The coefficients C and D are determined from a straight line fit to the data of volume versus gage height plotted on a log-log plot. If a simple straight line does not fit the data over the range of gage heights, straight line segments of best fit should be used. Thus, C and D of the segment containing the values of observed gage height would be selected.

The rate of change of $\forall$ with respect to time can be written as

$$\frac{d\forall}{dt} = CDh^{D-1}\frac{dh}{dt} \tag{4}$$

Substituting equations 2-4 into equation 1 and solving the resulting integral equation using a power series expansion (see Ref page 1), an expression for the time (hrs) required to draw the reservoir water surface elevation from one level to a lower level with constant inflow is obtained:

$$t = \frac{2CD}{E}\left[\sum_{i=1}^{N}\left(\frac{B}{E}\right)^{i-1}\left(\frac{h_I^{\frac{2D-i}{2}} - h_F^{\frac{2D-i}{2}}}{2D - i}\right)\right] \tag{5}$$

where, $E = 0.0826A\sqrt{\frac{2g}{K}}$, h_I and h_F are the initial and final water surface gage heights, respectively, and N is the number of terms in

the series expansion (magnitude of N depends upon desired accuracy). If the constant inflow (B) equals zero, then the terms for $i = 2, 3, \ldots, N$ equal zero, thus greatly simplifying the solution, i.e.,

$$t = \frac{2CD}{E}\left(\frac{h_I^{\frac{2D-1}{2}} - h_F^{\frac{2D-1}{2}}}{2D - 1}\right) \tag{6}$$

Substituting the definition of E into equation 5, the functional relationship in terms of the outlet works loss coefficient (K) is expressed by:

$$F(K) = \frac{2CD}{0.0826A\sqrt{2g}}\left[\sum_{i=1}^{N} Zi\ K^{\frac{i}{2}}\left(h_I^{\frac{2D-i}{2}} = h_F^{\frac{2D-i}{2}}\right)\right] - t \tag{7}$$

where:

$$Zi = \frac{B^{i-1}}{(0.0826A\sqrt{2g})^{i-1}\ (2D-i)} \tag{8}$$

Note: Z_1 is set to 1/2D-1 if inflow (B) equals zero.

c. Numerical Solution. The solution of equation 7 is obtained by a first order, Newton fixed point iterative scheme

$$K_{i+1} = K_i - \frac{F(K_i)}{F'(K_i)} \tag{9}$$

where K_{i+1} is the new approximation of the loss coefficient based on a previous approximation (K_i) and the value of the function (equation 7) and its first derivative ($F'(K_i)$) with respect to K . Differentiating equation 7 with respect to K ,

$$F'(K) = \frac{CD}{0.0826A\sqrt{2g}}\left[\sum_{i=1}^{N} \frac{i}{K^{i/2}}\, Zi\left(h_i^{\frac{2D-i}{2}} - h_F^{\frac{2D-i}{2}}\right)\right] \tag{10}$$

equation 9 as two terminating criteria. The first is defined by

$$\left|K_{i+1} - K_i\right| \leq \varepsilon \tag{11}$$

where ε is a user specified error tolerance. Its value in the program is set at 0.01. The second cirteria is that if convergence specified by equation 11 is not obtained in 200 iterations, the program stops. A third terminating criteria is used in equation 7 to minimize the number of terms (N) in the series since the GE637 is limited to a maximum exponent of 38. Computation is terminated when the difference between $F(K)_{i-1}$ and $F(K)_i$ does not exceed one percent, i.e.,

$$\left|\frac{F(K)_i - F(K)_{i-1}}{\frac{F(K)_i + F(K)_{i-1}}{2}}\right| \leq 0.01 \tag{12}$$

However, if equation 12 is not satisfied after 35 terms $(i = 35)$, the program stops and a message is printed stating that "reasonable accuracy cannot be obtained." If the period of observation is restricted to less than 24 hours, the criteria in equation 12 should be obtainable with $i < 35$.

d. Steps in Program Execution.

(1) Input variables defined.

(2) The initial value of the loss coefficient (K) is set equal to 1.0.

(3) If the inflow (B) is zero; Z_1 is set equal to unity and equations 7 and 10 are solved with $N = 1$; go to step 5.

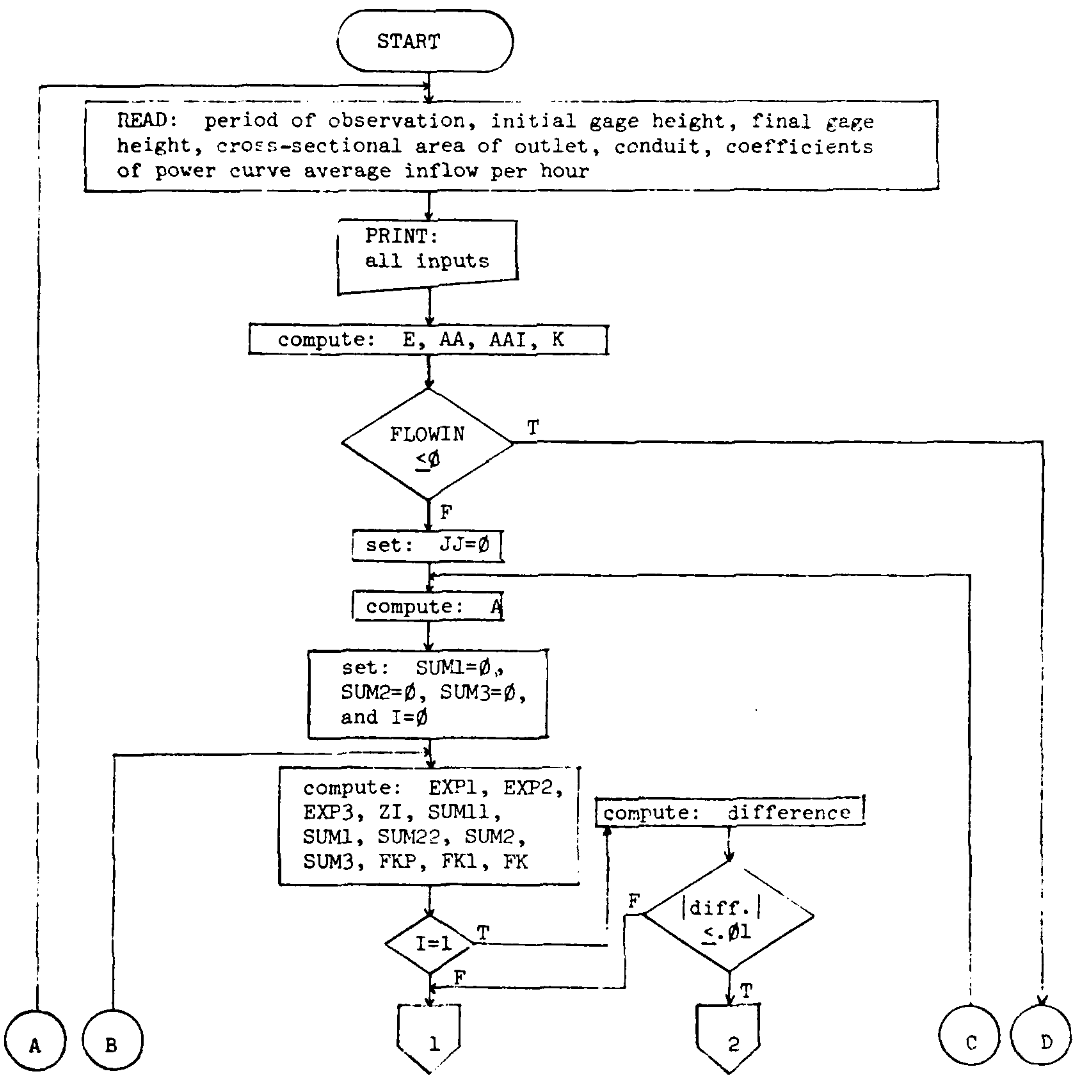
(4) If the inflow (B) is not zero, equations 7 and 10 are solved with $i = 1, 2, \ldots N$ until the difference between $F(K)_N$ and $f(K)_{N-1}$ is less than or equal to 1 percent. If N becomes greater than 35, the program stops and an error message is printed, "reasonable accuracy cannot be obtained with given data."

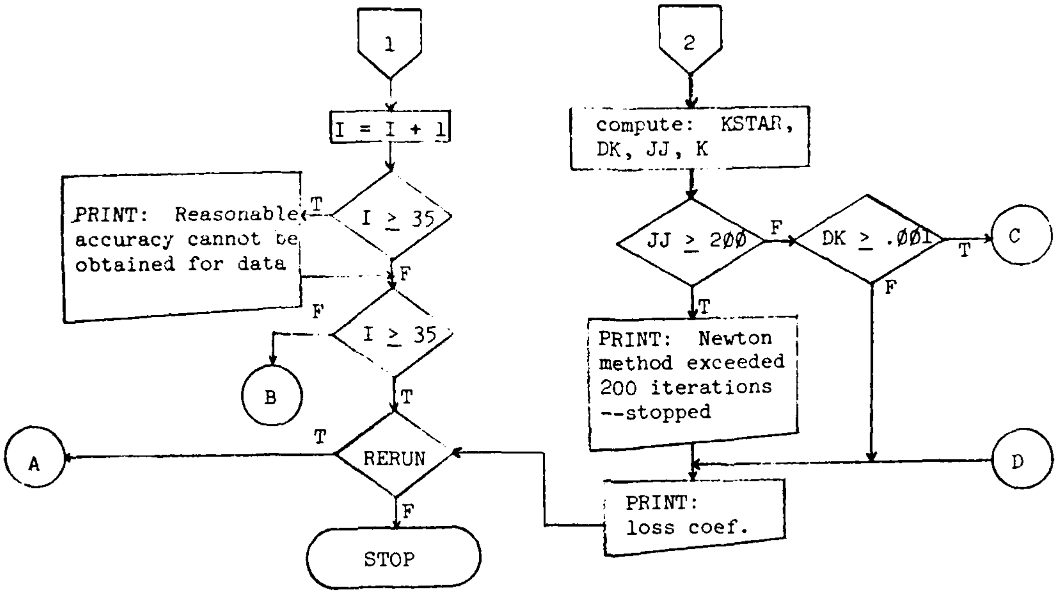
(5) Newton's method is applied to compute another approximation for K using equation 9 and the values of $F(K)$ and $F'(K)$ from step 3 or step 4. If the difference between the new approximation of K and the previous value of K is less than 0.01 (equation 11), the solution is complete and the results are printed. If the criteria of equation 11 is not satisfied, the program returns to step 3 or step 4 (depending upon the value of inflow) with the new approximation of K and repeats until equation 11 is satisfied or 200 iterations are reached. If the solution requires more than 200 iterations the program stops and a solution is not possible for the given input data. Once equation 11 is satisfied the results are printed.

PART II: COMPUTER FUNCTIONAL DESCRIPTION

1. REVISION LOG: N/A

2. FUNCTIONAL FLOW CHART:




1
2
I = I + 1
compute: KSTAR, DK, JJ, K
PRINT: Reasonable accuracy cannot be obtained for data
T
I ≥ 35
F
JJ ≥ 2ØØ
F
DK ≥ .ØØ1
T
C
F
T
F
I ≥ 35
B
T
PRINT: Newton method exceeded 200 iterations --stopped
A
T
RERUN
D
F
PRINT: loss coef.
STOP

3. EQUIPMENT AND OPERATING SYSTEM: The program was developed on a G635 time-share system in which input/output equipment consisted of a Model 33 remote teletype. It is now operational on the WES G635, Vicksburg, MS; HIS 66/80, Macon, GA; and Boeing CDC, Seattle, WA.

4. INPUT REQUIREMENTS: The required inputs are entered via the user's time-share terminal device in free-field format.

5. SECONDARY STORAGE INPUT: None.

6. INPUT DATA DESCRIPTION: The following names are used for the input variables in program H2251.

AREA - cross-sectional area of outlet conduit, ft^2

COEFFA - y intercept coefficient of power fit curve

COEFFB - slope of power fit curve

FLOWIN - average inflow, af/hr

HEAD1 - initial gage height, ft

HEAD2 - final gage height, ft

TIME - period of observation, hr

7. OUTPUT DATA DESCRIPTION: The follow name is used for the output variable in program H2251.

K - loss coefficient

8. PROGRAM MESSAGES: Return from all program messages is RERUN or STOP.

a. Reasonable accuracy cannot be obtained for data. Suggest decreasing time of observation in data collection.

b. Newton method exceeds 200 iterations - stopped.

9. VARIABLE DEFINITIONS:

A - temporary variable

AA - temporary variable

AAI - temporary variable

AREA - cross-sectional area of outlet conduit, ft^2

COEFFA - y intercept coefficient of the power fit curve in the gage height (ft) versus reservoir volume (af) relation

COEFFB - slope of power fit curve to the gage height (ft) versus reservoir storage (af) relation

DIFF - percent difference (fraction) between the value of $F(K)$, equation 7, and $F(K)_{i-1}$

DK - difference between the new approximation to the loss coefficient (K) and the previous value of K

E - temporary variable

EXP1 - exponent, i - 1

EXP2 - exponent, 2D - i/2

EXP3 - exponent, i/2

FK - functional relation in terms of K, equation 7, with the number of terms (N) in the summation equal to i

FK1 - same as FK except the number of terms (N) in the summation equal i - 1

FKP - the value of the first derivative of F(K) with respect to K, equation 1Ø

FLOWIN - constant inflow, af/hr

HEAD1 - initial gage height of reservoir water surface, ft

HEAD2 - final gage height of reservoir water surface, ft

HFILE - 5 character name of program (H2Ø5Ø); passed to WESLIB routine HACCT for bookkeeping

JKL - directs return from WESLIB routine RERUN to desired input read

K - outlet works coefficient

KSTAR - new approximation to loss coefficient K , equation 9

LQX - equal 1, print instructions from WESLIB routine RERUN; equal 3, no print

LQZ - equal 1, execute all input cues and reads; equal 2, call WESLIB routine RERUN and execute only desired reads

SUM1 - value of the terms summed in equation 7 for the initial gage height and N equals I - 1

SUM11 - same as SUM1 except N equals I

SUM2 - value of the terms summed in equation 7 for the final gage height and N equals I - 1

SUM22 - same as SUM2 except N equals I

SUM3 - value of the terms summed in equation 1Ø and N equals I

TIME - observation period, hr

ZI - value of equation 8 for each increment of i

ZZZZZ - 2 character; equal to RE, rerun; equal ST, stop

10. EXAMPLE CASE:

Input: Observation period (TIME) = 4.167 hr
Initial gage height (HEAD1) = 71 ft
Final gage height (HEAD2) = 7Ø ft
Cross-sectional area (AREA) = 16 ft^2
Coefficients of power curve (COEFFA) = .0435
(COEFFB) = 2.574
Average inflow (FLOWIN) = Ø af/hr

OUTPUT:

```
H2251 - CALCULATION OF OUTLET WORKS LOSS COEFFICIENT
  -      FROM PROTOTYPE MEASUREMENT OF DRAWDOWN

AA-ENTER PERIOD OF OBSERVATION (HRS).
=4.167

AB-ENTER INITIAL GAGE HEIGHT-FEET ABOVE OUTLET INVERT.
=71

AC-ENTER FINAL GAGE HEIGHT-FEET ABOVE OUTLET INVERT.
=70

AD-ENTER CROSS-SECTIONAL AREA OF OUTLET CONDUIT IN FT**2.
=16

AE-ENTER COEFFICIENTS OF POWER CURVE FIT TO GAGE HEIGHT(FT) VS RESERVOIR
VOLUME(ACRE-FT). FORM OF EQUATION: Y=A*X**B; WHERE Y EQUALS GAGE HEIGHT,
X EQUALS VOLUME AND A AND B ARE THE COEFFICIENTS. ENTER A AND
THEN B SEPERATED WITH A COMMA.
=.0435,2.574

AF-ENTER THE AVERAGE INFLOW PER HOUR IN ACRE-FT/HR FOR THE
PERIOD OF OBSERVATION.
=0

INPUT

PERIOD OF OBSERVATION =    4.17 HRS.
INITIAL GAGE HEIGHT(FT. ABOVE OUTLET INVERT) =    71.00
FINAL GAGE HEIGHT(FT. ABOVE OUTLET INVERT) =    70.00
CROSS-SECTIONAL AREA OF OUTLET CONDUIT =    16.00 FT**2
COEFFICIENTS OF POWER CURVE-GAGE HEIGHT VS RESERVOIR VOLUME.
FORM OF EQUATION: Y=A*X**B WHERE:
    A =     0.04350
    B =     2.57400
INFLOW =    0.   ACRE FT/HR


OUTPUT H2251:
LOSS COEFF. =      16.7128


ENTER RERUN OR STOP
=STOP
```

REF: ER 1110-1-10 - ENGINEERING AND DESIGN - Engineering and Computer Program Library Standards and Documentation, Appendix C

PART III: FILE DOCUMENTATION

1. REVISION LOG: N/A

2. TITLE: H2251 - Calculation of Outlet Works Loss Coefficient from Prototype Measurement of Drawdown.

3. PROGRAM SOURCE LISTINGS: See pages 14-17.

4. NUMERICAL AND LOGICAL ANALYSIS:

   Newtons first order fixed point iteration scheme is used.

5. SUBROUTINES NOT DOCUMENTED IN ABSTRACT: None

6. MISCELLANEOUS: The program is part of the CORPS computer system. CORPS is an acronym standing for Conversationally Oriented Real-Time Program-Generating System. The program is now operational on the WES G635, Vicksburg, MS; HIS 66/8Ø, Macon, GA; and Boeing CDC, Seattle, WA. The source listing on page 14 contains the first line run command and brief for H2251. This first line run command runs the binary H2251B of the source listing on pages 15-17 (FORTRAN source of H2251) and attaches to WESLIB routines HACCT and RERUN.

03/02/79

H2251

```
0001*#RUN WESLIB/H2251R,R;WESLIB/REPUN,R;WESLIB/HACCT,R
0800 64  THIS PROGRAM COMPUTES THE LOSS COEFFICIENT OF A RESERVOIR OUT-
0810 65LET WORKS FOR A GIVEN GATE OPENING FROM DRAWNDOWN DATA, GIVEN THE
0820 64STAGE VS RESERVOIR VOLUME RELATION AND KNOWING THE AVERAGE IN-
0830 64FLOW RATE (MAY BE ZERO) DURING THE OBSERVATION PERIOD OF DRAWN-
0840 05DOWN.
0850 62  INPUTS REQUIRED ARE: DRAWNDOWN OBSERVATION PERIOD HR,INITIAL
0860 62AND FINAL GAGE HEIGHTS OF WATER SURFACE FT ABOVE OUTLET INTAKE
0870 61INVERT,OUTLET CONDUIT CROSS-SECTION AREA SQFT,COEFFICIENTS OF
0330 62POWER CURVE TO DATA OF GAGE HEIGHT FT VS RESERVOIR STORAGE AF,
0890 48AND THE AVERAGE INFLOW INTO THE RESERVOIR AF/HR.
0900 64  OUTPUT INCLUDES THE GIVEN DATA AND THE LOSS COEFFICIENT OF THE
0910 15OUTLET CONDUIT.
0999*06FINISH
```

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H2251S

```
00001*#RUN *=;/CORPS/H2251B(NOGO)
10000 LOZ=1;LOX=1;KKK=6; REAL K,KSTAR
10010 CHARACTER HFILE*5; HFILE=5HH2251
10020 PRINT 7
10030 7 FORMAT(//"H2251 - CALCULATION OF OUTLET WORKS LOSS COEFFICIENT
10040&"/11X,"FROM PROTOTYPE MEASUREMENT OF DRAWDOWN"/)
10050 15000 CALL HACCT(HFILE)
10060 GO TO(5,35),LOZ
10070 5 PRINT 10
10080 10 FORMAT(/"AA-ENTER PERIOD OF OBSERVATION (HRS).")
10090 READ,TIME
10100 GO TO(15,85),LOZ
10110 15 PRINT 20
10120 20 FORMAT(/"AB-ENTER INITIAL GAGE HEIGHT-FEET ABOVE OUTLET INVERT.
10130&")
10140 READ,HEAD1
10150 GO TO(25,85),LOZ
10160 25 PRINT 30
10170 30 FORMAT(/"AC-ENTER FINAL GAGE HEIGHT-FEET ABOVE OUTLET INVERT.")
10180 READ,HEAD2
10190 GO TO(35,85),LOZ
10200 35 PRINT 40
10210 40 FORMAT(/"AD-ENTER CROSS-SECTIONAL AREA OF OUTLET CONDUIT IN FT*
10220&*2.")
10230 READ,AREA
10240 GO TO(45,85),LOZ
10250 45 PRINT 50
10260 50 FORMAT(/"AE-ENTER COEFFICIENTS OF POWER CURVE FIT TO GAGE HEIGH
10270&T(FT) VS RESERVOIR"/"VOLUME(ACRE-FT). FORM OF EQUATION: Y=A*X**B;
10280&WHERE Y EQUALS GAGE HEIGHT,"/"X EQUALS VOLUME AND A AND B ARE THE
10290&COEFFICIENTS. ENTER A AND "/"THEN B SEPERATED WITH A COMMA.")
10300 READ,COEFFA,COEFFB
10310 GO TO(55,85),LOZ
10320 55 PRINT 60
10330 60 FORMAT(/"AF-ENTER THE AVERAGE INFLOW PER HOUR IN ACRE-FT/HR FOR
10340& THE"/"PERIOD OF OBSERVATION.")
10350 READ,FLOWIN
10360 GO TO(95,85),LOZ
10370 85 CALL PERUN(KKK,LOX,JKL)
10380 GO TO(5,15,25,35,45,55,95),JKL
10390 95 PRINT 100,TIME,HEAD1,HEAD2,AREA,COEFFA,COEFFB,FLOWIN
10400 100 FORMAT(/"INPUT"//"PERIOD OF OBSERVATION =",F7.2,"HRS."/
10410&"INITIAL GAGE HEIGHT(FT. ABOVE OUTLET INVERT) = ",F7.2,/,"FINAL GA
10420&GE HEIGHT(FT. ABOVE OUTLET INVERT) = ",F7.2,/,"CROSS-SECTIONAL ARE
10430&A OF OUTLET CONDUIT = ",F7.2," FT**2",/,"COEFFICIENTS OF POWER CUR
10440&VE-GAGE HEIGHT VS RESERVOIR VOLUME."/,"FORM OF EQUATION: Y=A*X**B
10450&WHERE:"/,5X,"A = ",F10.5,/,5X,"B = ",F10.5,/,"INFLOW = ",F7.2," AC
10460&RE FT/HR"/)
10470 E=COEFFB-0.5
10480 AA=0.08264*AREA*SQRT(64.4)
```

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H2251S CONT.

```
AAI=COEFFA*COEFFB/AA
K=((TIME*E)/(AAI*(HEAD1**E-HEAD2**E)))**2.
IF(FLOWIN.LE.0.0) GO TO 130
JJ=0
8 A=AA/SQRT(K)
SUM1=0.0; SUM2=0.0; SUM3=0.0; I=1
9 EXP1=FLOAT(I-1)
EXP2=(2.*COEFFB-FLOAT(I))/2.
EXP3=FLOAT(I)/2.
ZI=(FLOWIN**EXP1)/(AA**EXP1*2.*EXP2)
SUM11=SUM1
SUM1=SUM1+ZI*K**(EXP1/2.)*HEAD1**EXP2
SUM22=SUM2
SUM2=SUM2+ZI*K**(EXP1/2.)*HEAD2**EXP2
SUM3=SUM3+ZI*FLOAT(I)*K**(FLOAT(I)/2.-1.0)*(HEAD1**EXP2-HEAD2**EXP
&2)
FKP=AAI*SUM3
FK1=(2.*COEFFA*COEFFB*(SUM11-SUM22))/A-TIME
FK=(2.*COEFFA*COEFFB*(SUM1-SUM2))/A-TIME
IF(I.EQ.1) GO TO 116
DIFF=(FK-FK1)/((FK+FK1)/2.)
IF(ABS(DIFF).LE.0.01) GO TO 120
116 I=I+1
IF(I.GE.35) PRINT 121
IF(I.GE.35) GO TO 135
121 FORMAT(/"REASONABLE ACCURACY CANNOT BE OBTAINED FOR DATA."/"
&SUGGEST DECREASING TIME OF OBSERVATION IN DATA COLLECTION."/)
GO TO 9
120 CONTINUE
KSTAR=K-FK/FKP
DK=ABS(K-KSTAR)
JJ=JJ+1; K=KSTAR
IF(JJ.GE.200) GO TO 125
IF(DK.GE.0.001) GO TO 8
GO TO 130
125 PRINT 126
126 FORMAT(/"NEWTON METHOD EXCEEDED 200 ITERATIONS-STOPPED"/)
130 PRINT 150,K
150 FORMAT(//"OUTPUT H2251:"/"LOSS COEFF. = ",F10.4)
135 LOZ=2
CHARACTER ZZZZZ*2
16000 PRINT 16002
16002 FORMAT(//"ENTER RERUN OR STOP")
READ 16001, ZZZZZ
16001 FORMAT(A2)
IF(ZZZZZ.EQ.2HRE) GO TO 15000
IF(ZZZZZ.EQ.2HST) GO TO 20000
PRINT,"ERROR *** RETYPE"
GO TO 16000
20000 STOP
```

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H2251S CONT.

10990 END

DATE

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